

National Aeronautics and Space Administration

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KSC NEWS

tech transfer

**Sparking New Technology in the
Electrostatics and Surface Physics Lab**

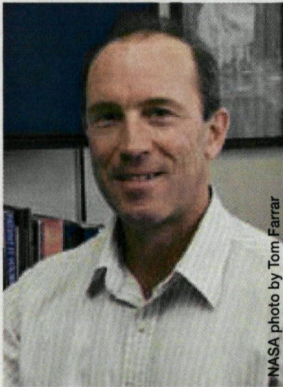
Lab founder and lead Carlos Calle, PhD, discusses some of
the breakthrough technologies currently in development.

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NASA photo by Tony Gray

Meet the Staff: Jeff Kohler, Technology Marketing Manager



Jeff Kohler

Jeff Kohler, technology marketing manager at Kennedy Space Center, is committed to searching out new and inventive ways to team NASA innovators with industry partners to bring value to NASA projects and transfer technology to the commercial marketplace.

Kohler fulfills this commitment through his work for Kennedy's Innovative Partnerships Program (IPP), which furthers technology development by forming partnerships between NASA and industry, academia, and other government labs. The IPP-facilitated technology development broadens the agency's technology portfolio, and then IPP seeks to transfer this innovation to the private sector and other government agencies.

"Many companies and industries are amazed there is so much technology development here at Kennedy, since it is primarily an operations center, but there are more than 30 labs supporting operations—and a lot of them are doing research—so there is a lot of good innovation here," Kohler said.

Kohler and his team use a variety of methods and tools to facilitate partnerships, including assessing New Technology Reports (NTRs), networking with industry contacts, exhibiting at conferences and trade shows, and contacting potential partners directly. Other strategies include reaching out to a certain industry, partnering with a co-inventor organization, or publishing the technology for free transfer.

"We have access to an internal database of contacts as well as an online subscription service that provides timely information about companies and is very easy to use to locate potential partners," he explained. Kohler is also tapping into new business networking opportunities, such as LinkedIn, to further broaden his team's scope of potential contacts.

The IPP team evaluates NTRs as they come in, looking for commercialization opportunities. The first step is an interview with the innovator for a recommendation about commercial possibilities for the technology.

"If there is potential, we get more involved and often ask industry contacts to look at the nonconfidential technology description," he remarked, adding that they also solicit the opinions of NASA scientists working in the subject area as well as non-NASA experts. "About 30 percent of the time, the NASA innovator already has a contact with a potential industry partner, which is very helpful as we can acquire industry feedback right away."

A relatively new strategy for the Kennedy IPP team is to put together joint-ownership and joint-commercialization agreements for technologies that are co-invented by NASA researchers and industry partners. For example, ASRC Aerospace and NASA innovators have collaborated on research in innovative wire fault detection and repair technologies. As part of this work, they have submitted dozens of NTRs that will be grouped together to create a portfolio of three patent applications under a joint-ownership agreement. NASA and ASRC will retain rights to the technologies, NASA will take the patenting lead, ASRC will be the technical lead, and the IPP will support the marketing effort.

"Both NASA and ASRC will benefit through royalty distributions if the technology is successfully commercialized," Kohler explained. "Using this strategy creates an opportunity for contractor and non-NASA innovators to benefit as well." ■

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Many companies and industries are amazed there is so much technology development here at Kennedy.

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— Jeff Kohler,
Kennedy's IPP

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Kennedy Tech Transfer News is the semiannual magazine of the Innovative Partnerships Program at NASA's Kennedy Space Center in Cape Canaveral, Florida. This magazine seeks to inform and educate civil servant and contractor personnel at Kennedy about actively participating in achieving NASA's technology transfer and partnership goals. Please send suggestions or feedback to the editor.

Special thanks for assistance with photography: Kevin O'Connell (cover, pp. 4-5) and Gina Mitchell Ryall (p.3)

New Technology Report (NTR)

Technology title: **Integral Battery Power Limiting Circuit for Intrinsically Safe Applications**

Inventors: **Bradley Burns and Norman Blalock**

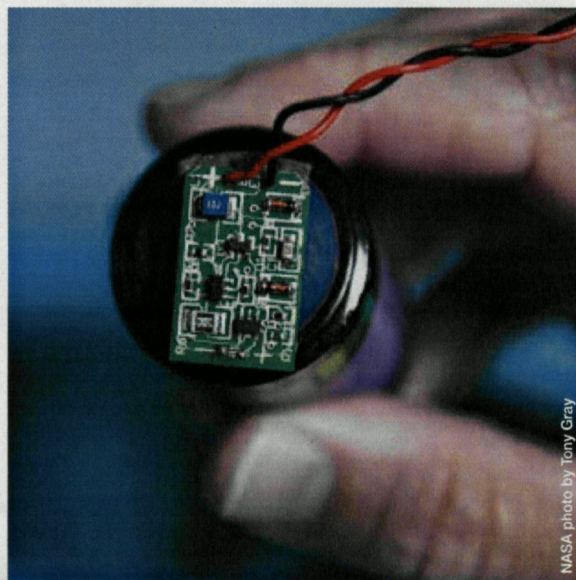
Case #: **KSC-12703-1**

What it is: The Integral Battery Power Limiting Circuit is designed to limit the power output from a battery without compromising battery lifetime in situations where there is little headroom for dropping voltage or wasting current. The invention was developed to ensure that the full power of the battery is not available in the event of a short circuit, cut in a cable, or similar event.

This technology prevents a spark emitted from a battery during a short circuit from possibly igniting volatile chemicals, while not drawing much additional power in the process. The device can shut off a circuit within 55 μ s—20 times faster than the fastest rated fuse. When deployed, the circuit monitors and clamps the current if it exceeds a predetermined threshold voltage, thus shutting down the application. While the current is disabled, the circuit periodically sends out a small test current to detect whether the fault has been corrected or removed. Once the fault is resolved, the circuit can restore full current.

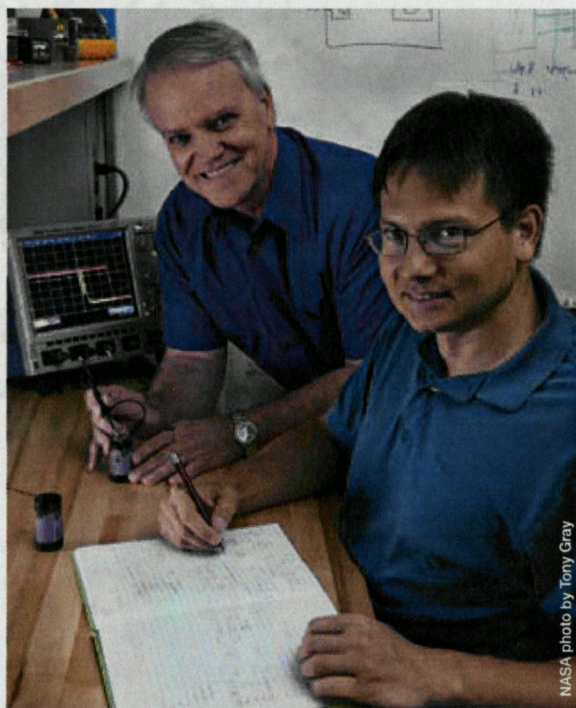
What makes it better: This technology overcomes the shortcomings of prior methods of battery-circuit monitoring. For example, some approaches use a diode or intrinsic safety barrier to protect against reverse polarity. These methods suffer from added voltage drop, leaving insufficient remaining voltage for most applications. By contrast, NASA's technology produces a much smaller voltage drop. In one test, the added drop in standby mode was 10 mV, compared to upwards of 700 mV in more conventional approaches. In addition, tests indicate no detectable reduction in battery lifetime using the power-limiting circuit. The final package was designed with the circuit board small enough to be mounted and potted under the cap of the battery, resulting in only 0.125 inches additional battery height.

How it might be used: The circuit technology is primarily useful in battery-powered applications for hazardous environments, such as transportation of hazardous materials, offshore rigs and pipelines, mining, gasoline pumps, and hybrid vehicles. Recently, Texas-based consulting firm Jerry West LLC licensed the technology for use in the oil and gas industry, specifically to measure fluid levels in oil wells. ■



NASA photo by Tony Gray

Integral Battery Power Limiting Circuit for Intrinsically Safe Applications



NASA photo by Tony Gray

Inventors Norman Blalock (left) and Bradley Burns

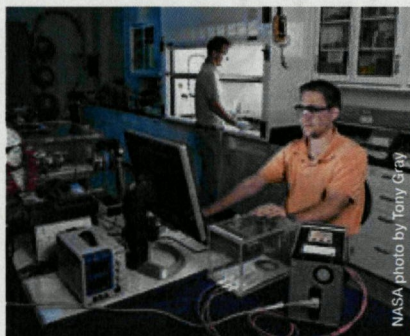
Carlos Calle, PhD, founder and lead of the Electrostatics and Surface Physics Laboratory at Kennedy Space Center, spoke with Kennedy Tech Transfer News about some of the breakthrough technologies in development at the lab. This interview took place in April 2010, one day after President Barack Obama visited Kennedy and outlined his exploration goals for NASA.

Can you talk a little about President Obama's recent visit?

The President delivered a speech that was quite exciting for the future of NASA and space exploration. He committed the agency to development milestones leading to a new manned spacecraft; a powerful new rocket; and a host of technologies to protect space travelers, vehicles, and instruments from the hazards of deep space. Our electrostatics lab is right in the middle of these efforts because we are developing technologies for exploration beyond low Earth orbit.

What exactly is electrostatics?

Electrostatics is a branch of physics that studies the phenomena of static electricity. We look at electrostatics from a surface point of view, analyzing the electrostatic charge that generates on material surfaces. In practical terms, it is a safety issue. The buildup of electrostatic charge by itself is not a problem, but the possible rapid discharge of that buildup may disrupt communications and damage computer chips and electronic equipment. More importantly, a rapid discharge may cause an ignition if there is a flammable material in the vicinity. Launching rockets, we have flammable materials here, so we try to control and monitor possible hazards. In April 1964, a Thor-Delta third-stage rocket ignited prematurely, killing three technicians. The rocket exploded as the technicians removed a plastic cover from the rocket, causing a spark of static electricity.



NASA photo by Tony Gray

Michael Johansen

equipment, International Space Station modules, and payloads. We are ready with resources and equipment to solve electrostatic problems. For example, we get calls from personnel with the shuttle program and at launch facilities to gauge potential hazards when a new material is being used and is in danger of generating an electrostatic charge. We help assess and mitigate risks wherever possible.

On the space exploration side of our work, we develop unique instrumentation for planetary science and are developing the only active dust-mitigation technologies in existence.

What are some of the unique technologies you're working on?

We are particularly excited about our work on the Electrodynamic Dust Shield (EDS), in development here since 2004. We first worked with the University of Arkansas at Little Rock to mitigate and prevent the

What does the Electrostatics and Surface Physics Lab do?

We perform research and development on technologies that can assist not only operations at Kennedy but also at other NASA centers to detect, mitigate, and prevent electrostatic charge generation and discharge on space flight hardware, ground support

accumulation of dust on solar panels for Mars missions. The project is now part of the NASA-wide Dust Management Project. We are focused on preventing dust accumulation on solar panels, optical instruments, spectrometers, viewports, seals, joints, and spacesuits. The technology is simple and quite exciting. It is the only active technology that exists for the removal of dust on surfaces or for the prevention of dust accumulation on surfaces.

This project is very important because dust accumulation on surfaces is a huge issue for Mars and lunar explorations. Though we are not going to the moon on manned missions, there will be unmanned



NASA photo by Tony Gray

Mike Hogue



Electrostatics and



NASA photo courtesy of the Electrostatics and Surface Physics Laboratory

Surface Physics Lab

lunar missions where this technology will be important. And we are going to Mars, as the President has said, and we will continue to send landers and rovers to Mars before sending manned missions.

Mars is a dusty planet. It is covered with a fine dust, and every 15 months to 3 years, the entire planet is engulfed in a global dust storm that lasts months and uploads large amounts of dust into the atmosphere. Aside from the global storms, “dust devils,” which are tornado-like columns of spinning dust, occur daily at any given location. Over time, dust accumulates on solar panels, decreasing efficiency and eventually rendering panels inactive. We plan to keep panels and instruments clear of dust with this technology.

We also recognize the tremendous commercialization possibilities for this technology, and we are working with Kennedy’s Innovative Partnerships Program (IPP) on that aspect as well.

Are there additional success stories you would like to highlight?

Our lab was part of the repair mission for the Hubble Space Telescope in 2008. The power board for the imaging spectrometer needed to be replaced,

exposing an electronics board to space for the first time. Our lab analysis showed that electrostatic fields potentially generated by astronaut suits and gloves could damage the board. As a result of our work, a new method for installing the board in orbit was designed.

Other problems we have investigated in recent years include possible electrostatic generation on thermal control system blankets, shuttle crew escape equipment, orbiter fuel line covers and actuator blankets, the Ares I-X triboelectric issue, Ares I antenna, and the Orbiter Processing Facility vacuum system.

Also, we were able to provide the theory behind adding the electrostatic component to software developed by DEM Solutions, Inc., that provides accurate modeling of lunar dust and regolith. Capabilities offered by this technology are benefiting several U.S. companies. *(For more information about the DEM Solutions software, see page 7.)*

Can you discuss the lab’s solar energy collaborative work with the Florida Solar Energy Center?

That work built on the EDS projects. One of our researchers worked closely with the Florida Solar Energy Center (FSEC) to test whether our dust-mitigation technologies integrated with the FSEC



NASA photo by Tony Gray

Sarah Snyder

solar panel system would affect the system’s optical properties and solar cell efficiency. Results showed that the additional coating did not significantly degrade system performance as compared to the plain covered glass normally used. The FSEC tests showed that our technologies performed very well.

What are some next steps for the lab, in light of the President’s goals for the agency?

We will focus on participating fully in developing the breakthrough new technologies the President is calling for to enable exploration beyond low Earth orbit. Specifically, we will be working on instrumentation and sensors to perform science studies on Mars as well as dust-mitigation technologies. We also will continue to assist Kennedy and NASA with issues related to electrostatic discharge, triboelectric charging, and electrical grounding issues for spaceflight hardware and ground support equipment. ■

Carlos Calle, Making Science Understandable

In addition to his work with NASA, Dr. Carlos Calle has authored several books about physics for general audiences. Reviewers describe his writing as accessible and fascinating. His books have been translated into Dutch, Spanish, Serbian, French, Korean, Chinese, and German.

- *Superstrings and Other Things: A Guide to Physics, Second Edition*, CRC Press, 2009
- *The Universe: Order Without Design*, Prometheus Books, 2009
- *Coffee with Einstein*, Duncan Baird Publishers, 2008
- *Einstein for Dummies*, Wiley Publishers, 2005

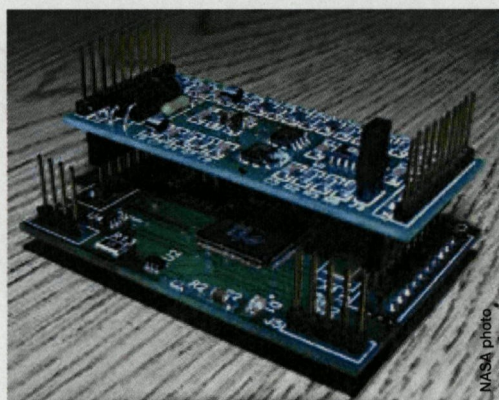
Portable Device to Monitor Valves in Nuclear Power Plants

Exclusive license agreement reached with firm specializing in “smart sensors”

A technology originally developed to increase the safety and reliability of NASA's space vehicle launch systems will be used at nuclear power plants to monitor the condition of electromechanical valves.

About the Technology

The Smart Current Signature Sensor technology monitors the electrical and mechanical health of solenoid valves by comparing the electrical current profile of each solenoid actuator to a typical current profile and reporting deviations. NASA engineers developed the technology for use by the Space Shuttle Program for its ground support equipment (GSE) and vehicle valves, where the health of electromechanical systems and specifically of



solenoid valves is a primary concern.

The system exploits the fact that unique characteristics, or signatures, of the solenoid current are affected by electrical and mechanical deterioration of the valve and its parts. Current signatures include characteristic

peaks and valleys that repeat at well-defined times during every operating cycle and have well-defined magnitudes and shapes. This technology noninvasively senses the electrical current signature of the solenoid valve being monitored, processes that signal, monitors and records peaks and valleys of the electrical current, and records the time corresponding to each peak and valley. Embedded intelligent algorithms compare the electrical current signature with a profile and provide a notification when out-of-specification conditions are encountered.

This innovation advances the field of noninvasive monitoring systems and is especially significant because it increases safety and reliability by proactively identifying failures and degradation of solenoid valves *before* they occur, preventing system damage and human injuries. At NASA, the potential of delaying scheduled launch of vehicles and/or personnel injury due to failure of electromechanical systems requires launch personnel to continuously inspect and test GSE and flight-system valves to confirm their readiness. Furthermore, disassembly inspection and testing of these systems pose an additional potential risk of hardware failure. Detecting degradation and/or potential problems before they occur not only provides for safer operation but also saves costs for unnecessary inspections.

License to Graftel

In 2008, Kennedy's Innovative Partnerships Program licensed the patented technology to engineering firm Graftel, Inc. Located in Elk Grove Village, Illinois, Graftel designs, manufactures, and calibrates a full line of testing instrumentation for the nuclear power industry. The company's "smart sensors" have been used in the United States since 1993 and have proven to decrease test durations and set-up times. Under an exclusive licensing agreement, Graftel plans to develop a handheld testing device for the nuclear power industry.

The device will perform diagnostic testing on electromechanical valves used in nuclear power plants. Plant operators will be able to validate that valves in their plants are open or closed and operating correctly. Graftel's device will assess solenoid valve health and notify system operators of any problems so that preventive repairs can be made before actual failures occur.

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Graftel expects that the application of this technology to nuclear power plants will result in cost savings to the plants while at the same time increasing reliability and decreasing occupational dose [of radiation] to plant personnel.

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— James Glover,
Graftel president

Lower Costs, Higher Reliability

“Graftel expects that the application of this technology to nuclear power plants will result in cost savings to the plants while at the same time increasing reliability and decreasing occupational dose [of radiation] to plant personnel,” according to James Glover, Graftel president. The successful transfer of this innovation to Graftel won an honorable mention for the 2009 Award for Excellence in Technology Transfer from the Southeast Region of the Federal Laboratory Consortium for Technology Transfer.

Graftel expects to have working units to demonstrate for customers within the next year. The company also has indicated that it will market its product to the electric utility industry. ■

IPP Seed Fund Partnership Answering Questions about Moon Dust

Software provides accurate modeling of lunar dust, regolith

A partnership between Kennedy Space Center and an industry leader in particle dynamics simulation software and discrete element modeling (DEM) is producing dust-mitigation technologies that will protect space vehicles and sensitive equipment from lunar dust contamination.

Partnership with DEM Solutions

Kennedy's partnership with Scottish firm DEM Solutions Ltd. was established under the auspices of the Innovative Partnerships Program (IPP) 2007 Seed Fund. The IPP Seed Fund provides "bridge funding" that enables partnership and development efforts. The program requires matching funds from an industry partner and support from one or more existing NASA programs or projects.

In this case, DEM Solutions was able to leverage previous IPP-funded work where the company had collaborated with NASA to develop custom solutions for modeling the effects of electrostatic forces on particles. The new work enhanced the existing software to provide more accurate modeling of lunar dust and regolith—with the potential to improve design quality and provide significant savings, especially with respect to field testing.

"This was a great collaboration," said Carlos Calle, PhD, lead of Kennedy's Electrostatic and Surface Physics Laboratory. "The experience of the staff at DEM Solutions in modeling complex particulate systems such as those encountered in space applications gave us the confidence that they would be a strong partner."

"This NASA IPP project enabled us to extend the capabilities of our EDEM® particle modeling software for NASA's applications," noted Richard LaRoche, PhD, vice president of engineering and U.S. general manager of DEM Solutions. "But this project also spawned innovations resulting in advanced features that our current customers now use for modeling cohesive materials and particle-fluid systems."

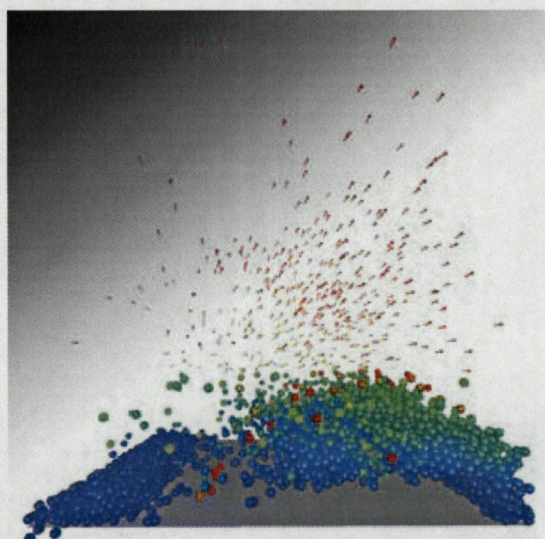
Technology Essential for Lunar Exploration

Understanding more about the chemical and physical properties of lunar dust and the role of static electricity buildup on dust particles in the lunar environment is essential to the development of technologies for removing and preventing dust accumulation and successfully handling lunar regolith. "The problem of dust accumulation on surfaces is a significant issue for lunar explorations," said Dr. Calle. "There will be lunar missions where this technology will be important," he explained. (For more information on Calle's work with dust-mitigation technologies, see pages 4-5.)

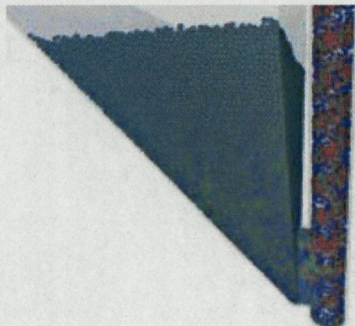
Benefits for U.S. Firms

NASA is not the only organization looking to benefit from this technology. According to Carol Plouffe, PhD, engineering manager for John Deere, this work is of great interest to the company. "Most of the agricultural and construction machinery developed by Deere involves the movement of bulk materials, and Deere has long recognized that DEM is one of the most promising approaches to simulation of such systems," he said. By developing modeling capability for lunar regolith, Dr. Plouffe said, "the project is likely to solve some of the modeling challenges we face on Earth with cohesive or sandy soils." Other U.S. companies benefiting from the technology are Pfizer and Procter & Gamble. ■

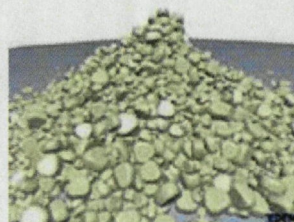
EDEM is a registered trademark of DEM Solutions Ltd.



This EDEM simulation shows dust particles being removed from a dust-screen under the influence of an electric field and associated dielectrophoretic forces.



In this EDEM simulation of a lunar regolith transport system, material is loaded into the hopper and transported for processing via a rotating-screw auger mechanism. The particles here are colored by velocity.



In material calibration studies for lunar regolith, the EDEM tool helps investigate the effects of various parameter settings on an angle of repose.

Images provided by DEM Solutions

SBIR Technologies Yield Successes for NASA and Industry

The Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs, which are administered by NASA's Innovative Partnerships Program (IPP), give small high-tech companies and research institutions the opportunity to participate in government-sponsored research and development (R&D). Under the programs, NASA benefits from a cost-effective way to infuse technology into its missions, and small businesses develop technology with commercial potential.

The highly competitive, three-phase SBIR award system provides qualified small businesses with opportunities to propose innovative ideas that meet the specific R&D needs of the federal government, as described in an annual solicitation. Phase 1 is a feasibility study to evaluate the scientific and technical merit of an idea. Awards of up to \$100,000 are for periods of up to 6 months for an SBIR and 12 months for an STTR. Phase 2 is for technology development of a prototype, expanding on the results of and further pursuing the development from Phase 1. Awards are for periods of up to 2 years in amounts up to \$750,000 (beginning in program year 2010). The technology infusion and/or commercialization occurring in Phase 3 further builds upon accomplishments from Phase 2 and requires the use of private sector or non-SBIR federal funding.

Highlighted here are two examples of SBIR contracts that have produced innovations that have directly benefitted NASA missions and provided commercial success for the small businesses.

Phase 1

Phase 2

Phase 3

Innovation Provides "Light Engines" for NASA Bio Systems



Photo courtesy of Orbital Technologies Corp.

An efficient high-tech lighting system has the potential to provide tremendous energy cost savings to commercial plant growers. Orbital Technologies Corporation (ORBITEC) of Madison, Wisconsin, worked with researchers at Kennedy Space Center to develop a High-Efficiency Lighting with Integrated Adaptive Control (HELIAC) system through SBIR funding.

The HELIAC system consists of small individual light-emitting diode (LED)

"light engines" that provide a level of control and precision far in excess of standard lamps. This precision enables lamp configuration to be adapted to species-specific growth habits so that photons are absorbed efficiently by all available photosynthetic tissues. In addition, the lighting adjusts its emissions to target new tissues as plants grow in height or spread and automatically detects the proximity of plant tissue and powers only adjacent light engines, so as not to waste photons by lighting empty space. The system is expected to substantially lower the energy costs of controlled-environment production.

For NASA, the technology has applications in plant research and in large plant-growth facilities as part of advanced life support systems, which will be necessary for long-term planetary exploration. In addition to the potential for significant power savings over existing lighting systems, the use of solid-state lighting eliminates problems associated with traditional lighting in closed systems, such as short operational life (requiring resupply); limited control options; and safety concerns such as high temperatures, glass envelopes, and toxic materials.

Commercially, the technology has applications in agriculture, primarily in greenhouse and aquarium lighting.

The NASA funding that has come through the SBIR contracts allowed ORBITEC to take the technology to the next level. The company has patented an aquarium lighting system that is scheduled to enter the commercial market later this year and is currently testing a greenhouse lighting system for potential release in 2011.

Composite Patches Save Time, Money in Structural Repair

Cornerstone Research Group (CRG) received NASA funding to help develop a polymer technology that has applications ranging from the launch pad to the race track.



Photo courtesy of Cornerstone Research Group

Headquartered in Dayton, Ohio, CRG has participated in NASA's SBIR/STTR programs since 1999 and more recently (program year 2004) received a contract through Kennedy to

further develop its polymer technology.

The company's shape memory polymer (SMP) has applications ranging from deploying objects in space to manufacturing dynamic molds. The technology exhibits a radical change from a normal rigid polymer to a stretchy elastic and back on command, a change that can be repeated without degradation of the material. The "memory," or recovery, quality comes from the stored mechanical energy attained during the reconfiguration and cooling of the material.

The Veritex™ composite patch uses CRG's patented Veriflex® resin as its matrix. When heated above its activation temperature, the Veritex patch becomes pliable and can easily be reformed into any shape. When cooled and restrained in its new shape, the material regains its structural stiffness and keeps its new shape.

Continued on page 9

Composite Patches Save Time, Money in Structural Repair Continued from page 8



Photo courtesy of Cornerstone Research Group

The composite patch saves significant time and cost in repairing composite materials and other surfaces. Instead of fully replacing a piece of equipment, the technology allows a user to repair damage, offering structural support, weather resistance, and secure repair. Unlike tape, the patches will not delaminate during use.

General applications for the technology include use with automotive components, dynamic structures and habitats, adaptive reinforcement, and composite repairs. Specialized applications have been developed for outdoor equipment and race car repair. ■

Veritex is a trademark and Veriflex is a registered trademark of Cornerstone Research Group.

IPP and Researcher Discuss NASA's Biomedical Research, Spinoffs



In April, the IPP's Jeff Kohler and biomedical engineer Don Doerr spoke at the Moffitt Cancer Center and Research Institute's annual employee appreciation day. In addition to being one of the country's leading cancer hospitals, the Tampa-based center employs more than 135 investigators that have been conducting a variety of scientific research since the early 1990s. Attendees were excited to hear about the many technology "spinoffs" that had emerged from NASA—both within and outside of the medical field—as well as the biomedical research and technologies benefiting NASA's astronauts. ■

Pittcon 2010: Kennedy Technologies on Display, STEM Promoted



NASA photo

NASA was invited to exhibit at Pittcon 2010, the world's premier conference and exposition on laboratory science, attracting more than 10,000 attendees from industry, academia, and government. In the center of the exhibition hall in the Orange County Convention Center in Orlando, Florida, the NASA booth developed by Kennedy's Public Affairs Office featured various areas of the center's technology R&D. Representatives of the IPP promoted Kennedy technologies and facilities, such as a spectrometer calibrator, hydrogen leak sensing tape, self-validating thermocouple, and the integral battery power limiting circuit (*see page 3*)—several of which sparked the interest of various companies. They also distributed copies of *Spinoff* magazine and *Kennedy Tech Transfer News*. Proceeds from Pittcon help fund science education and outreach at all levels, attracting kindergarteners and adults alike toward science, technology, engineering, and math (STEM). ■

IPP Takes NASA from *Open Innovation* to *Breakthroughs* and Beyond

More than mere buzz words, breakthroughs and innovation are the lifeblood of science and discovery. They lie at the core of NASA's mission-enabling research and development (R&D) efforts.

Two books on innovation have gained a stronghold of business support in the past few years. And NASA's approach to R&D—particularly as supported by the Innovative Partnerships Program (IPP)—provides concrete examples of how these trends in innovation can and should be more than a passing fad.

In 2003, Henry Chesbrough's book *Open Innovation: The New Imperative for Creating and Profiting from Technology* made popular the notion that providing an environment in which knowledge can freely flow in and out of an organization accelerates internal innovation and expand markets for the external use of that innovation. In this paradigm, external ideas become as important as internal ideas both in developing new innovation and in finding paths to bring that innovation to market.

NASA's IPP has long been applying principles of Open Innovation through its efforts to facilitate technology "spinoffs" to form commercial products as well as technology infusion to bring ideas and technologies into NASA to help meet mission requirements beyond the traditional avenue of procurement contracts.

Andrew Hargadon's book, *How Breakthroughs Happen: The Surprising Truth About How Companies Innovate* (also published in 2003), demonstrates that breakthroughs are the result of collective efforts to combine and adjust existing ideas and innovations in new ways. Hargadon posits that innovation can happen by building networks of people and organizations, breaking them free of isolated work and integrating otherwise unrelated ideas and technologies to address new problems and challenges.

This, too, is a concept long valued by NASA. Linking organizations—even those "unusual suspects" that may do business in fields far removed from spaceflight and exploration—can provide fast and more cost-effective value toward the development of new innovation. NASA's IPP has been demonstrating this through the formation of partnerships with industry, academic, and other government organizations. In partnership, NASA and its collaborator contribute value to address the other's technology need, enabling both parties to solve problems using fewer resources.

Indeed, NASA's IPP has been combining the ideas set forth in *Open Innovation* and *How Breakthroughs Happen* since its inception. This combination of bringing internal and external ideas together through partnerships—even with seemingly unrelated organizations—to support R&D is shown in Exhibit 1. As illustrated, the act of looking outside the organization's walls occurs early in the R&D process—ideally before any investment in R&D has occurred. If external technology solutions exist or if the commercial marketplace would have interest in the resulting R&D, then the collaborations illustrated in *Breakthroughs* and the free-flow of ideas proposed in *Open Innovation* occur.

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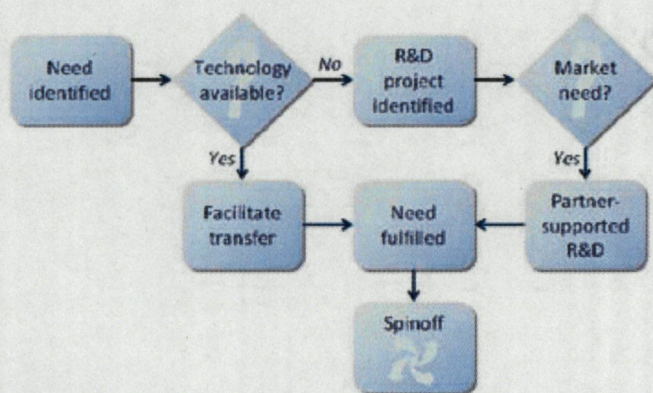


Exhibit 1: Bringing Together the Concepts in *Open Innovation* and *How Breakthroughs Happen*

Adapted from "Investigate before Investing: Using Technology Transfer Principles to Guide R&D," presented at the 2005 International Astronautical Congress, used with permission of Fuentek, LLC.

Want to learn more about "open innovation" and applying those principles to your work?

Attend the training session:

Open Innovation at NASA's Kennedy Space Center

**Monday, August 30 • 9 a.m. to 11:30 a.m.
or 1:00 to 3:30 p.m.**

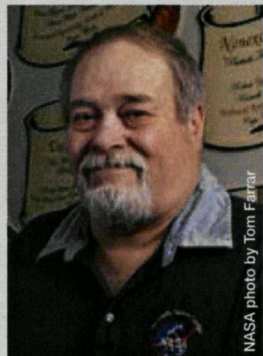
(choose either morning or afternoon session)

Offered in the KLI Building. For details, please call Carol Dunn at 867-6381.

To register, visit <https://saturn.nasa.gov>.

Data Rights: Just Because You Paid for It, Doesn't Mean You Own It

In a continuing series of articles on intellectual property issues, Kennedy Tech Transfer News asked the center's patent counsel Randy Heald to give a brief overview of the issues surrounding data rights.



NASA photo by Tom Farrar

Randy Heald

1. What do we mean by "data" when we discuss data rights?

"Data" is information "recorded" in the process of creating a product. So if NASA orders a contractor to manufacture and deliver a widget, the widget itself is *real* property, while the specifications, plans, manuals, and/or software developed in creating the widget are *intellectual* property (IP). When the contractor delivers the widget, the title automatically passes to the government—that is, NASA owns the real property. Not so with intellectual property.

2. But doesn't NASA own the data since it paid for the widget?

No. This is a common misconception. Many people think, "We paid for it, so we must own it." But federal regulations state that the government can only *license* the rights to the IP. Granted, NASA can license unlimited rights to the data; however, the agency must "order" those data rights at the time it is "ordering" the real property. So although NASA ordered the widget, it does not automatically receive the widget *data*. NASA must order those data in the contract.

3. Why would NASA want to have the widget data?

Data support the entire lifecycle of a program, well beyond operating or repairing the widget. With the data, NASA can more easily enhance competition among suppliers for future acquisitions and ensure logistics support. Having the data helps NASA fulfill its responsibilities to disseminate and publish the work to benefit the nation and foster later technology development.

4. But if having the data is so important, why can't the contract say that the contractor has to deliver all of the data?

Current government policy is to acquire only those data and rights that are essential to meet the government's needs. Remember: Having to provide

data to NASA imposes an administrative and cost burden on the contractor. If data acquisition requests are excessive, that is not good for the contractor, nor is it good for NASA. Plus, contractors should be allowed to protect the IP they created at their own expense and try to maintain their competitive edge.

5. So what does go into the contract?

There are various FAR [Federal Acquisition Regulation] clauses that contracting officers can use. The important thing for program and project personnel to remember is: You have to *order* the data you need in advance. Regardless of whether you asked the contractor to develop something, you cannot obtain possession of any data not ordered in the contract. So when a contract requests R&D that results in the manufacture of a widget, the contract should also order all associated R&D data. Additional data can be ordered later *if* the appropriate clauses are included in the original contract.

6. So how do I make sure the contract orders all of the data needed?

Work with the contracting officers in procurement and with patent counsel. They rely on the experience of operations, sustaining engineering, and program management personnel to consider historical scenarios to identify future data needs. They also can help balance the potential need for data with the estimated costs of data delivery. ■

For more information, contact Randy Heald (867-7214, Randall.M.Heald@nasa.gov).

IPP Takes NASA from Open Innovation to Breakthroughs and Beyond (continued from page 10) • • • • •

This notion can be seen through successful SBIR contracts resulting in benefits for both NASA and small businesses (see pages 8–9), as well as countless licensing success stories (see page 6) and IPP Seed Fund partnerships (see page 7) that result in value for both NASA and its partners.

NASA's IPP is truly leading the way in trends in innovation, helping to make valuable breakthroughs happen for NASA missions and programs. To learn more, contact Kennedy's IPP by calling 861-7158 or 867-6384. ■

Lone geniuses laboring in the basement laboratory don't invent the future; networks of people connected to each other and to new ideas produce innovation in the real world. I see that happening at NASA, especially through IPP, which links otherwise disconnected communities through networking and partnerships.

— Andrew Hargadon, author of *How Breakthroughs Happen*

Meet Tony Maturo, Director of NASA's Inventions and Contributions Board



Tony Maturo

Director of the Inventions and Contributions Board (ICB), Tony Maturo, has been in his present position since the fall of 2007. Tony previously was the deputy at the Academy of Program/Project and Engineering Management (APPEL). In this position, he was responsible for the finances, acquisition, and curriculum actions and products. Tony's previous experience is felt in the energy, team building, process documentation, and marketing experience he brings to his present position.

Do you think the ICB is as relevant today as it was at its conception in 1958?

Overall innovation due to the end of the cold war has been overshadowed by performance of the Space Shuttle Program. The current administration is trying to rekindle the creative/innovative spirit for the next generation of NASA projects.

You have made some changes to how you perceive your job functions should be performed.

When Walter Hussey (the previous ICB director) asked me to become the ICB director, he wanted me to make the program more visible. He also asked me to document the processes and increase the budget. Some of the changes include involving the Award Liaison Officers at the board meetings, publishing an annual report, and participating in Space Act Award ceremonies at the centers and in exchanges with other government and nongovernment

organizations. The documentation of ICB processes has been improved by the revision of internal NASA procedures, the deletion of certain outdated phrases in the Code of Federal Regulations, the future documentation of common actions (1099, Change of Address, Deceased/Beneficiary), etc. The ICB budget has increased by \$250,000 over the past 2 years to cover the cost of labor and staff members and to increase the money for awards.

How has the Software of the Year and the Invention of the Year changed?

The ICB team and the Software Policy Group under the leadership of Dr. John Kelly have developed a professional rapport reflected in the evaluation criteria of the last two Software of the Year Competition letters. The marketing of the Software of the Year and the Invention of the Year awards has been recognized at PM Challenge the past two years. We believe that this has greatly improved the process.

What changes do you see in the near future?

With the creation of the Office of Technology, the ICB could be working closer with the Innovative Partnerships Program. ■

Inventions and Contributions Board Awards

October 1, 2009 to April 15, 2010

To be eligible for any of these awards, innovations must have a New Technology Report (NTR) on file. For the Board Action Award, NASA Form 1329 also must be completed. For more information, contact Kennedy's Awards Liaison Officer: Carol Dunn (867-6381; Carol.A.Dunn@nasa.gov).

Board Action Awards

Emission Control System
by Clyde Parrish†

Moisture Uptake Test Apparatus and Method for Materials under Cryogenic Conditions
by Kevin Boughner†, Robert Breakfield†, James Fesmire†, and Trent Smith†

New Test Methods to Measure the Incendivity as Well as the Onset of Brush Discharges from Insulators
by Carlos Calle†

Orbiter Radiator Retract Flexhouse Angular Measurement Ring
by Dale C. Smith and Antonio Rodriguez

Wireless Orbiter Hang Angle Instrumentation Software
by Jonathan Byon†, Angel Lucena†, and Jose Perotti†

Patent Application Awards

Removal of PCB and Other Halogenated Organic Contaminants Found in Ex Situ Structures
by Laura Filipek, Christian Clausen, Kristen Milum, Cristina Berger, Jacqueline Quinn†, Christina Clausen, and Cherie Geiger

Software Release Awards

Automated and Manual Rocket Crater Measurement Software
by Christopher Immer and Philip Metzger†

Network Scan Vulnerability Database (NSVD)
by Stefan Peterson

Electronic Lost and Found System
by Keith Braun, Gerard Floyd, and Ryan Hamoud

Tech Briefs Awards

Activated Metal Treatment System (AMTS)
by Kathleen Brooks, Cherie Geiger, and Christian Clausen

Configurable, Multi-Purpose Processor Technology for Responsive, Autonomous and Space-Based Capabilities: Command and Telemetry Processor (CTP)
by Richard Birr†, Christopher Forney†, and Robert Morrison†

Electrostatic Separator for Beneficiation of Lunar Soil
by Steven Trigwell, Ellen Arenst†, James Captain, Janine Captain†, Carlos Calle†, and Jacqueline Quinn†

Flow Detection System for the Orbiter Purge Vent and Drain Window Cavity Conditioning System
by Barry Slack†, Thomas Moss†, and Curtis Ihlefeld†

Low Dead-Volume Inlet for Vacuum Chamber
by Guy Naylor and Richard Arkin

Pyrotechnic Simulator/Stray-Voltage Detector
by Terry Greenfield

Situational Lightning Climatologies
by William Bauman† and Winifred Crawford†

Spacecraft Maintenance Automated Repair Tasks (SMART)
by Brent Mitchell, Elkin Norena, Martin Belson, Nadean King, Mary Jo Al-Shihabi, Louis Locklear, Derek Hardin, and Joseph Schuh†

†Civil servant

NASA's ICB Awards

Board Action Award: An award, up to \$100,000, based on such factors as the invention's significance; its stage of development; its actual use by NASA, the government, or industry; its potential for such use; and the level of creativity involved in making it

Patent Application Award: Awarded on receipt of a patent application serial number; \$1,000 for a sole inventor or \$500 each for multiple inventors

Software Release Award: Awarded when software is initially released by the center's Software Release Program to a qualified user for internal or external projects; \$1,000 for a sole inventor or \$500 each for multiple inventors

Tech Briefs Award: Awarded when an article is approved for publication in the *NASA Tech Briefs* magazine; \$350 per inventor